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valuable record of observations made on the lines defined by previous writers, especially by Eschricht and Voigt, on the human subject. It forms a valuable summary of previous work, adding much material for future research, but advancing no hypotheses. In this the author was consistent with the cautious conservatism which characterized his life.

Taking a comprehensive view of the zoological work of Dr. Allen in connection with our knowledge of his personality, we are most impressed with its conscientiousness united to an unselfishness only too rare among men of Science.

In a personal acquaintance with Dr. Allen as a student of zoology, the author was early impressed with his serious and deliberate, almost solemn, consideration of the subject in hand. A more intimate acquaintance revealed his geniality and humor and his philosophic interest in created things.

He never reached conclusions hastily even on subjects of minor import. His faculty, may it not be said his genius, for tentative suggestion as to the significance of phenomena was exercised in such a conservative way that it could neither mislead nor be misconstrued as a declaration of belief. His sincerity of purpose, his humility, and his love of nature endeared him to his associates and emphasize their regret for his loss.

DR. ALLEN'S CONTRIBUTIONS TO ANTHROPOLOGY.

BY DANIEL G. BRINTON, M. D.

The field of science, strictly so-called, which Dr. Allen cultivated, was that of anatomy, and primarily human anatomy.

He understood this science, however, in a very different sense from that in which it is usually presented in medical schools. He was not at all in sympathy with the programme which reduces anatomy to the position of a handmaid to clinical surgery. Such a method he considered not only unworthy the true relations of anatomical study, but ultimately an injury to practical medicine itself; because etiology is the only sure guide to rational practice; and etiology means nothing so much as the investigation of progressive tissue-change, in other words, histological and gross anatomy.

It was in this spirit that he applied his profound and minute knowledge of human and comparative anatomy to medical and surgical questions, and with the same broad grasp he attacked the problems

of somatology or anthropologic anatomy. His contributions to this latter branch it will be my effort to sketch.

Its special aim is to set forth clearly and to estimate justly the anatomical difference which we find, on the one hand, between races or varieties of the human species, and on the other, between this species itself and those below it in the scale of organized beings.

It is, in the fullest sense of the word, *morphology*: the study of forms and their fluctuations under the influences of environment, nutrition, correlation, heredity and pathological processes, the endeavor always being to trace the given form to its etiological factors. Thus its methods are those of inductive science in the truest sense. Yes, they go beyond this; they lead up, in their highest expression, to laws and formulas which are cosmic in application, and express the universals of knowledge.

This was fully recognized by Dr. Allen, and he gave it expression in the memorable phrase, "Morphology embraces all animated structures as parts in a scheme of Philosophy."

I wish to emphasize this dictum, because all his work in the somatic field of anthropology was dominated by, and must be read in the light of, this wide conception of its meaning.

No greater mistake could there be than to imagine that this recognition of the indefinite value of observations led him to seek premature generalization or to neglect minuteness of details. The opposite is true, and it were hard to find an example of a more painstaking, laborious student of the smallest features of individual and racial anatomy.

I could not bring to your knowledge a more striking example of this than one of his earliest contributions to anthropologic anatomy, one published more than thirty years ago in the *Dental Cosmos* for November, 1867.

Its subject is *The Jaw of Moulin-Quignon*, a title which will probably not be very full of meaning to many of you, so I must premise by explaining it.

When the celebrated French antiquary, Boucher de Perthes, made his discovery of hand-made stone implements in the preglacial gravels of Abbeville, it was objected to him that no human bones had been found among those of the elephants and hippopotami in the strata. He saw the force of this objection and offered a handsome sum to any of the quarrymen who should make such a discovery. It is not surprising that in a short time such a human

relic was found, the half of a lower jaw, imbedded in the gravel about fifteen feet below the surface. He announced it with glee, but the jaw met with such an equivocal reception that a mixed English and French commission of expert geologists, archæologists and anatomists, was appointed to repair to Abbeville and settle the discussion. The result could have been predicted. The committee convened, talked, inspected the gravel pit and went away, each member being more than ever convinced that his former view was correct.

This took place in 1863, and for several years there continued a lively debate as to the authenticity of the find, eminent scientists arraying themselves on each side.

Without referring to other points in the controversy, I shall mention only that which attracted Dr. Allen—the anatomical peculiarities of the bone. It was argued by those who believed the find to be genuine, that the characteristics of this lower jaw were so marked that it must have belonged to a race of men widely divergent from the present inhabitants of France. It was to this special question that Dr. Allen addressed himself. He divided it into two headings, as follows:

1. What is the pattern of an ordinary jaw?
2. What is the value of the lower jaw in Man, as a test character of race?

You will form some idea of the amount of labor which the author bestowed on this paper when I add that in its preparation he visited every important anatomical collection in Philadelphia, measured and handled more than four hundred inferior maxillaries, and based his results on the close comparison of three hundred and twenty, from adults and in perfect condition.

I have space to give his conclusions only, which are so far-reaching and based on such exhaustive observation, that they should be committed to memory by every student of racial anatomy. The first refers to the bone under consideration, and is this:

“The lower jaw is of little value as a test character of race owing to its wide variations in every race.”

The second is a generalization which bears upon comparative racial anatomy as a whole; to wit:

“Any character or group of characters, pertaining to any single bone, lose their value when used in framing general conclusions.”

In the application of the principle here annunciated, lies the aim of most of Dr. Allen's subsequent work in comparative racial anat-

omy. He was never satisfied with describing variations merely. To his acute and orderly mind they remained valueless and meaningless until their full significance, both as cause and consequence in the complete morphology of the individual, was set forth.

This masterly grasp of the inter-relation of anatomical facts was finely illustrated by his various communications in the *Proceedings* of this Academy and elsewhere, on the consequences brought about when the immediate ancestor of Man gradually adapted himself to walk upright instead of upon "all fours."

Dr. Allen traced most of the special anatomical characteristics of Man to this evolution from a quadrupedal to a bipedal type. He pointed out how it led to a new disposition or re-arrangement of the special organs, such as pushing the heart over to the left side due to the flattening of the sternum, and changes in the position of the teeth. He took pains to point out also that our species is still far from being entirely adapted for the erect position, as is evidenced by the inadequate valvular mechanism of the veins, the shape of the pelvis and other features.

Such considerations led him in one of his later papers, read before the Congress of American Physicians and Surgeons, (1894), to point out the practical application of morphology as a factor in the etiology of disease. This essay is full of interesting matter for the anthropologist, and is largely based on comparative racial anatomy.

He justly says: "The scientific study of race in connection with diseased action is almost an unbroken field."

I have space to mention only two of the highly important conclusions reached in that essay.

The first is the striking distinction which he draws between specialization and degeneration in Man, as compared with analogous processes in the lower animals. I illustrate it by his example of the change from a quadritubercular to a tritubercular tooth in the human species. Dr. Allen remarks of this: "We can say with certainty that the loss of a cusp in a human molar tooth is associated with decreased initial energy; and that such changes are not due, as in the lower animals, to adaptation to special, and as a rule to higher ends."

The second point in this paper of the greatest interest to anthropologists, is the contrast which Dr. Allen draws between the skeletons of civilized and uncivilized men. The bones of civilized peo-

ples are marked by an absence of correlation, or, to use his own expression, "The bones themselves appear to become individualized."

This presents a curious analogy to the sociological results of civilization, for it is generally acknowledged that the highest product of culture is the development of the individual life, and the specialization of mental activities.

Dr. Burt J. Wilder, in commenting on this address, remarked that the fundamental thesis of the author appeared to be that *structure is a record of function*. Though Dr. Allen did not directly accept this rendition of his philosophy, my own impression is that it is in full accord with his teachings.

The study of morphology from its artistic or pictorial side led Dr. Allen, in 1875, to the publication, in the *Transactions of the American Philosophical Society*, of his suggestive treatise entitled *An Analysis of the Life Form in Art*. It covers 71 quarto pages, and the text is illustrated by 185 figures. The chief aim of the author was to analyze those art forms of early or savage peoples which have originated in models found in nature; to point out those peculiar traits in animals and plants which caught the eye of the primitive artist; and to set forth the passage from the realistic to the conventional in early design.

Such models as the palm-tree, the serpent, the man, the lion, etc., are selected as examples, and traced with minuteness in their representations in ancient and uncultivated art.

This was a delicate and difficult task, and it must be said that it would not be safe to follow all of Dr. Allen's identifications. The study of primitive decorative art has made rapid progress in the last score of years, and the principles it now accepts were scarcely known that long ago. Still, this work may be studied with profit, and the accurate and philosophic conception of life form which everywhere guides the author, leads him to many suggestions of permanent value.

A portion of it is devoted especially to subjects from aboriginal American design and pictography, which is an added claim to its consideration by the archæologist.

In the last few years of his life Dr. Allen devoted much time to researches in craniology proper, endeavoring to place that vacillating branch of anthropology on a secure footing.

In 1894 he proposed in the *Proceedings* of this Academy a new method of determining the plane of the skull, and in 1896 advo-

cated the adoption of a uniform method of describing its form and parts. In general theory, he followed Dr. James Aitken Meigs in his classification, and pointed out that the quite recent plan of Professor Giuseppe Sergi is little more than a return to Meigs' methods.

He was the first (in 1891) to suggest the term "pedomorphism" as signifying the retention of infantile and adolescent traits in the adult skull, and extended the connotation of the term to the whole skeleton. He gave this characteristic a more exact value, by showing that it is present in greater or lesser degree in every skull, and he urged that such traits should form a part of the description of every specimen.

The chief results of his studies in craniology are included in two remarkable memoirs. The earlier was published in the *Journal* of this Academy for 1896, entitled *Crania from the Mounds of the St. Johns River, Florida: a Study made in connection with Crania from other parts of North America*.

The reception which this memoir received among craniologists was most favorable. Professor Emil Schmidt, of Leipzig, one of the most competent judges in Europe, said of it at the close of a review in the *Centralblatt für Anthropologie*: "This is the most important contribution to craniological science which American scientific literature has offered for a long series of years."

It would be quite impossible to do it justice in a few words, and and it would be inappropriate here to enter into its technical details. It may be sufficient to say that it advances a new and more complete terminology than that now generally in use; that various novel and ingenious instruments for measurement are described; and that the comparisons instituted are of the most thoroughgoing kind.

These lines of thought and others of an allied nature were continued in a memoir, not yet published, but which will soon appear in the *Transactions* of the Wagner Free Institute of Science. Its subject is a series of skulls from the Hawaiian Islands, some from caves, others from shore burials.

As this memoir was completed by Dr. Allen but a few weeks before his death, it may be considered to embody his maturest opinions, and I shall give it, therefore, a somewhat full examination.

The same terminology is adopted in it, as in the previous memoir referred to, and the methods of investigation are the same or anal-

ogous. It illustrates his constant aim to establish some other, and if possible more stable, criteria of cranial comparison than those in common use; and, on the other hand, to subject the latter to a much closer criticism than they have heretofore received.

In the former direction he emphasizes the significance of the presence of the prenasal fossa as determining grade; points out the value of the infraorbital suture, which is generally neglected; and offers as entirely new the comparisons of the pyramidal process of the palatal bone and the prominence or recession of the zygoma when the skull is viewed from above. He estimates with precision the signification of pedomorphism as a sign not so much of arrested as of incompleting development.

One of the most striking results reached is, in his own words, that "the differences between the crania are not due to race, but to methods of living, and in some degree to differences of mental strength in individuals." This modest statement by no means conveys the full import of his demonstration. What his laborious, skilful, and accurate measurements show, taken in conjunction with the proved unity of race but diversity of nutrition and culture-conditions of his specimens, is that the ordinary contrasts in skull-forms, upon which many stately theories of races and schemes of prehistoric interminglings have been erected, are of such doubtful significance that they are inadequate for that purpose.

Pursuing this line of research further, Dr. Allen asked himself, what is the proximate and remote etiology, what are the immediate and more distant factors in the modification of skull forms? In this memoir he brings out some of these with force, while others which, had he lived, he would have developed fully, are merely suggested. Thus, the correlation of the loss of the upper front teeth with important variations in cranial conformation is admirably set forth; and the influence of diseased action causing disuse, and thus, in turn, lessening nutrition and modifying shape and contour, is clearly explained.

Some inquiries which he advanced tentatively were of far more weight in his own mind than his expressions indicate. For example, in the last conversation I had with him, a few days before his decease, he asked my attention particularly to the consideration whether the whole range of exanthemata, and especially measles, to which the white race has been time out of mind exposed and is now largely immune, are not chargeable with many of its peculiar char-

acteristics in facial and cranial anatomy. It was clearly his intention to present this from a much wider comparative scheme had his life been spared.

He almost incidentally refers to a subject which interested him deeply and on which he would have made more extended examinations; that is, as above mentioned, the mental capacity of the individual as a distinct cause of modified skull form. While this in itself is not new, he aimed to approach it by novel tests.

The last lines of that memoir are indicative of his loftier estimate of craniology than a mere criterion of race. As such, he did not esteem it highly; but he saw in the investigation of the nutritive, psychical, cultural and morbid processes which alter the cranial contours, admirable illustrations of those profound forces which shape and mould life forms everywhere, and are the underlying momenta of all morphology, whether of plants or animals. In this comprehensive sense, craniology takes just rank among the great and leading subjects of scientific investigation.

Another feature in the memoir which will attract the student is a novel graphic method of displaying similarities and differences of skull form. Dr. Allen called it the "terrace method," and it has obvious advantages over the curvilinear graphic systems now in use.

This brief review of Dr. Allen's labors in one branch of learning would be still more imperfect did I neglect to record some of his personal characteristics as a student and teacher of science. Everywhere his work was marked by a singular modesty of claim, by entire justice to the labors of others in the same field, by gentleness in criticising their results, by constant willingness to assist those who sought information, by an earnest desire to stimulate the love of knowledge for its own sake, and by unceasing efforts to present this knowledge in its broadest relations both to human welfare and abstract science.

DR. HORN'S CONTRIBUTIONS TO COLEOPTEROLOGY.

BY JOHN B. SMITH.

When it is said that poets are born, not made, it is putting in a loose and popular form the fact that men are unequally endowed at birth; that special faculties are inborn in some who, if they are